DEPARTMENT OF THE INTERIOR, CANADA

HON. CHARLES STEWART, Minister; W. W. CORY, C.M.G., Deputy Minister

DOMINION WATER POWER AND RECLAMATION SERVICE

J. T. JOHNSTON, C.E., Director

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WATER-POWERS OF MANITOBA 1926

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With the Compliments of the
Honourable Charles Stewart,
Minister of the Interior,
Canada.

FOREWORD

The facts contained in the following brief review of the water-powers of Manitoba are chiefly based upon the surveys and investigations carried out during the past fifteen years by officers of the Dominion Water Power and Reclamation Service, Department of the Interior. These investigations have involved the establishment of a comprehensive scheme for the complete development of the Winnipeg river in Manitoba, a similar scheme for the Saskatchewan river at Grand Rapids, and the Nelson river at Whitemud Falls, while detailed field studies have been made of the power possibilities of such rivers as the Wanipigow, Manigotagan, Bloodvein, Berens, Pigeon, Grass, Burntwood, Dauphin, Fairford, Waterhen, Mossy and Churchill. Records of daily discharge have been secured on most of the rivers in the southern part of the province for a considerable period of years and sufficient records on the more northerly rivers to indicate, approximately, their flow characteristics, but, for a thoroughly accurate estimate of the power possibilities at any water-power site flow records should be available for many years. Accordingly the estimates of power which appear in the following list are subject to revision as more is learned of the flow characteristics of the various rivers. The figures however are considered to give a very fair estimate of the power possibilities of the province.

Lynx Falls, Grass River, Manitoba.

WATER-POWERS OF MANITOBA

GENERAL

Among the most important of the natural resources of a country are those that furnish power, and the material progress of a country may be measured largely by the extent to which these resources are available and utilized. The use of power has extended into almost every field of human effort and is now an essential factor in the production, preparation and marketing of agricultural and other natural products, in the operation of manufacturing industries, of public utilities and transportation systems, and in the supplying of the varied conveniences and comforts of community life.

The Dominion of Canada as a whole has been exceptionally well endowed with these resources of power, and they are so widely distributed and so easy of access and development that there are now few communities of any size that are not supplied with power at a very low cost. These sources of power are found in the waterways scattered across the Dominion from end to end; in the vast coal fields of British Columbia, Alberta, Saskatchewan, and Nova Scotia, and, to a limited extent, in the natural gas and oil fields of southern Alberta and Ontario.

Manitoba has certain deposits of fuel in the form of lignite but its water-powers are of outstanding magnitude and are already playing an important part in the industrial life of the province. The extent of these resources may be appreciated when it is stated that there is available on the various rivers of the provinces a total of more than 3,000,000 continuous horse-power under conditions of ordinary minimum flow, and more than 5,000,000 continuous horse-power at ordinary six-month flow. At sites already developed there is at present a total turbine installation of 225,800 horse-power, with provision to increase these plants to an ultimate capacity of 310,000 horse-power.

The province of Manitoba has a total area of some 250,000 square miles, of which nearly 20,000 square miles comprise the water surface of the numerous lakes and rivers. The most marked physical features of the province are these same lakes and rivers, which form the collecting-basins and drainage-systems, not only of the province itself, but of an immense area in the neighbouring provinces and states. The three large lakes, Winnipeg, Winnipegosis and Manitoba, lying in the south central portion of the province, have a combined surface area of more than 13,000 square miles, and the largest of these, lake Winnipeg, collects the run-off from the southern parts of Alberta, Saskatchewan, and Manitoba, from large areas in northwestern Ontario, and from portions of the states of North and South Dakota, and Minnesota. The principal rivers draining these areas are: the Saskatchewan, which rises in two main branches on the slopes of the Rocky mountains in Alberta and flows eastward across the prairies, finally discharging into lake Winnipeg near its northern end; the Red, which rises in South Dakota and flows northward, entering the same lake at its southern end; the Assiniboine, which drains southeastern Saskatchewan and southwestern Manitoba and joins the Red river in the city of Winnipeg; and the Winnipeg river, which drains large areas in Ontario and Minnesota and enters lake Winnipeg at its southeastern extremity. Numerous lesser rivers drain the territory

to the east and west of the lake, the drainage from the west including the lakes Winnipegosis and Manitoba. Lake Winnipeg discharges at its northern end into the Nelson river, which flows northward and eastward and discharges into Hudson bay at Port Nelson.

The Nelson River system, which has a total drainage area of some 450,000 square miles, is one of the largest on the continent and includes most of the important power sites of the Prairie Provinces. About three-fifths of the area of the province of Manitoba is included in the basin of the Nelson river, the remainder being drained by the Churchill and Hayes rivers and several smaller coastal streams, all of which drain into Hudson Bay. The Churchill river, the largest of these, rises in Alberta and flows eastward across north central Saskatchewan and northern Manitoba, finally discharging into the bay at Fort Churchill. The Hayes drains that part of northern Manitoba to the east of the basin of the Nelson river and discharges into Hudson bay at York Factory, a few miles east of Port Nelson.

The value of the rivers of Manitoba as sources of power depends mainly upon the topographical characteristics of the province, and these in turn are the result of various geological formations and the alterations that have taken place in the past. The province may be roughly divided into two areas, each with distinct characteristics of its own. The dividing line of these areas commences at the southern boundary, a few miles east of the lake of the Woods, and extends northward and westward following the eastern shore of lake Winnipeg and then continuing northward and westward to the Saskatchewan boundary. The area to the west of this line forms part of the Great Central Plain of North America and consists largely of land suitable for agriculture, although generally well forested, except in the southwestern section. In this area the rivers, as a rule, have fairly flat gradients with few rapids or falls. Opportunities for power development are few, and the only power sites of importance are in the northern parts. These rivers, too, have wide variations in flow, due to the absence of lakes as natural regulating agencies in their basins and to climatic conditions. The area to the east of the dividing line forms a part of the great Laurentian Plateau. The surface of this area is, in general, rough and hilly although the hills are of no great elevation above the surrounding country. The maximum elevations in Manitoba are about 1,200 feet in the northwestern part and about 1,000 in the southeastern part; and the country slopes gradually northeast to the shores of Hudson bay. This region contains practically no agricultural land, although there are small areas of glacial clay spread over its surface supporting heavy growth of forest. All of this area contains almost innumerable lakes, muskegs and swamps, and the rivers may be described as chains of rock-bound basins connected by short, narrow channels containing rapids or falls. It is on these rivers that the important power sites of the province are found. The narrow channels and natural falls, combined with rock banks and beds provide numerous opportunities for cheap power developments. The numerous lakes and swamps also provide a large measure of natural regulation of the flow and afford excellent opportunities for artificial regulation.

Precipitation in the province of Manitoba ranges from about 18 inches in the southern part to an average of 15 inches in the northern part, with an average of 20 inches on the watersheds lying in the eastern part of the province. The run-off of the various rivers, although dependent upon the precipitation, is largely influenced by the character of the country and the climatic conditions. The low run-off occurs during the winter months and the high run-off during the spring and early summer. Records of stream-flow on the more important rivers in the province have been obtained over a period of years by the Dominion Water Power and Reclamation Service, and these form a reliable basis for an estimate of power at the various sites indicated in the following tables.

ADMINISTRATION

The water-powers of Manitoba and the Prairie Provinces are administered by the Minister of the Interior under the terms of the Dominion Water Power Act of 1919 and the regulations thereunder dated October, 1921. The Act provides that the water-powers are to remain vested in the Crown; no outright sale of them being permitted, but they may be leased to any approved licensee for a definite term of years upon certain specified conditions. Provision is made in the Act for exercising an effective measure of control over not merely the developments themselves, but also over all the auxiliary works necessary for storing and using the waters and for transmitting power, as well as the construction of the works and the management of the properties. To this end a statutory authority is established with the right of control, not only of the power site, but of all the lands, works, and operations necessary for the development and use of power.

The Dominion Water Power Regulations made in pursuance of the Act define the principles on which the administrative procedure is based. There are two leading principles underlying the Regulations, namely: to adequately safeguard the public interest in the Dominion water-powers by carrying out the provisions and intentions of the Act, and to protect the legitimate rights of those who undertake their development, including the capital which they invest.

As stated before, the water-powers of Manitoba are only leased upon certain specified conditions. To obtain a license the applicant must file certain plans and other information, so as to show fully what is proposed to be done and its effect upon other structures or interests, and must prove that he is financially able to carry out his proposed undertaking. The license itself is issued in two stages: first, the interim license, which is granted as soon as the application has been definitely approved, before construction begins, and which remains in force until the development is completed, and second, the final license, which is intended to be in force during the whole period of operation. The interim license, besides stating the conditions upon which the Crown Lands may be used and under which the development is to be constructed, also contains the principal conditions which are afterwards to be embodied in the final license. These include the quantity of water which may be used or diverted, a brief description of the undertaking, stating the use which is to be made of the power, and, if a public utility, the territory within which it may be distributed or sold, the term of the final license and the rental payable annually during the first 20 years. The final license is, in fact, a renewal or a confirmation of the interim license, and after certain preliminary conditions have been fulfilled, and is granted to the licensee as a matter of right after the satisfactory fulfilment of these preliminary conditions. There is, however, this important difference between the interim and final licenses which is necessary for the protection of the public interest. The former may be summarily cancelled in case the licensee fails to begin construction within a specified time; the latter can only be cancelled by an order of the courts and that only as an extreme and final measure. The final license is granted for a period not exceeding fifty years and at the end of that time may, or may not be renewed, according to conditions then prevailing. The license may be terminated and the works taken over by the Crown at any time after thirty years of the term of the license have expired and compensation is provided for in accordance with certain principles laid down in the Regulations. The rental during the first twenty-year period varies according to a sliding scale from a maximum of 90 cents to a minimum of 75 cents per horsepower-year, decreasing as the load factor improves. An additional rental may also be charged for Crown Lands used or occupied. The Regulations also provide a simplified procedure for granting licenses for small water-powers not

exceeding five hundred horse-power capacity. In this case the license is for a maximum term of twenty years, renewable for successive terms of five years and subject to compensation based upon principles similar to those applicable to the larger power sites.

In the administration of the water-power resources, the policy of the department is, in brief: to encourage desirable development of water-power resources; to discourage and prevent the initiation and development of uneconomic and wasteful projects; to ensure that each site developed shall utilize or provide for the future utilization of the maximum available power; to ensure that river systems are developed along comprehensive lines wherein each unit is a component link in a system; to ensure adequate storage measures in the interests of all powers affected; to prevent unnecessary and costly duplication of expenditures on the part of competing plants; to protect the public from inadvisable power schemes and ill-advised plants and dams; to safeguard the public from monopolistic control by regulation and periodical revision of rates; to see to the early carrying into effect of agreements issued by the department for the development of power; to compel the development of existing plants to their limit when the market demands; and to promote in every way the fullest conservation of the power resources of the West.

Slave Falls, Winnipeg River, Manitoba.

Before making any grant of water-power privileges, the department through the engineers of the Dominion Water Power and Reclamation Service, makes a most searching investigation into the engineering features of the proposed undertaking, supplemented by a study of its economic phases, the market to be served, and other sources of competing power, including fuel-power. The systematic investigatory work which has been under way for some years past has provided all the detailed data required to deal with the majority of power applications. When such data are not available special investigatory work is instituted. Upon the analysis and thorough consideration of all the data available, the department bases its action with respect to the granting of water-power privileges. This action is frequently negative. Uneconomic projects are not

authorized, while those offering prospects of economic success receive every encouragement. From the surveys and investigations already made, data pertaining to most of the power sites in the province are available and information concerning these may be obtained on application to the Director of the Water Power and Reclamation Service, Ottawa.

POWER RESOURCES

Agriculture has long been, and continues to be, the basic industry of Manitoba, and the rich farming lands of the southern and southwestern parts of the province, with their unexcelled productiveness in cereal and other crops, have attracted settlers in increasing numbers from year to year. The growth of the rural population has been accompanied by a corresponding growth of the population of the towns and cities, which act not only as distributing centres for the adjacent districts, but, especially in the larger cities, as centres of numerous manufacturing industries to supply both the domestic and export market. The increase in the industrial development of the province is evidenced by the value of the manufactured products, which now reaches $100,000,000 annually and is divided almost equally between the output of the milling industry and that of other industries.

Whitemud Falls, Nelson River, Manitoba.

This development of the manufacturing industry in the province has been centred chiefly in Greater Winnipeg (which includes the city of Winnipeg and the surrounding municipalities), and has largely depended for raw materials, apart from the products of agriculture, on sources outside the province. During the last few years a start has been made in the development of the mineral resources of the province and quite recently of the pulp-wood resources of its forest areas. Approximately one-half of the provincial area is essentially forest land and while the timber thereon has been logged for many years for saw-mill purposes it is only recently that development of the pulp industry involving the use of hydro-electric power has made its appearance and a most modern pulp-mill capable of considerable expansion is now in operation at Fort Alexander

Pointe du Bois Development of the City of Winnipeg, Winnipeg River, Manitoba.

Pinawa Development of the Winnipeg Electric Railway Company, Limited, Pinawa Channel, Winnipeg River, Manitoba.

on the Winnipeg river. The mineral resources are found in the eastern and northern parts of the province, and many valuable finds of the precious metals and other valuable minerals have recently been made at different places. Development of these resources on a large scale is to be expected within the next few years, and much work has already been done. In mineral development, many properties have passed the investigation stage and commercial production is already under way in several districts.

In the development of manufacturing industries and in their future expansion, as well as in the development of the timber and mineral resources, water-power has been and will continue to be the controlling factor, and the province is very fortunate in having available large amounts of power strategically situated to supply the needs of all districts. In the south and southeast, the Winnipeg river, with its exceptionally attractive power-sites, is within easy transmission distance of the industrial centre of Greater Winnipeg, and also of the mineral and forest areas of the district. Existing power plants on this river are already supplying some 200,000 horse-power for the needs of this market, and the increasing demand for power will call for the development of the remaining sites on the river within a comparatively short period.

In the northern and western parts of the province, the future requirements for power can be met by the developments on the Nelson, Churchill and Saskatchewan rivers, all of which have large amounts available at various sites. Many other rivers of smaller sizes have power available in lesser quantity, but sufficient for the needs of local use in mineral production, etc.

POWER RIVERS

The most important of the power rivers of the province, from the standpoint of present utility, is the Winnipeg river, which supplies the greater part of the power at present being used in the province, and has available large amounts easily developable and within comparatively short transmission distance of the chief centre of population and industry. Surpassing the Winnipeg in available power, but at present unutillized owing to lack of a market, are the Nelson and Churchill rivers, the power of which taken together includes three-quarters of the total power resources. Many other rivers have important power resources, such as the Saskatchewan, the Pigeon, the Berens, the Fairford, and other lesser streams.

Brief descriptions of the more important rivers are given below.

Winnipeg River

The Winnipeg river drains an area of 53,500 square miles, of which 37,900 square miles is in Ontario, 11,000 square miles in Minnesota, and 4,600 square miles in Manitoba. The basin is of typical Laurentian formation and contains innumerable lakes, swamps and muskegs, which provide an exceptional natural regulation of the flow, such that the ordinary yearly flood discharge seldom has been greater than from three to four times the minimum discharge.

The river heads in two main branches, known as the Rainy and English rivers, respectively. The former discharges into the lake of the Woods, and from this lake the Winnipeg river proper flows northward to where it is joined by the English river, about four miles east of the Ontario-Manitoba boundary, and thence westward and northward to its mouth at lake Winnipeg.

Although the greater part of the drainage basin of the river lies outside the province, the most important power reach of the river is in Manitoba. Complete topographic surveys have been made and hydrometric data obtained for this reach by the Dominion Water Power and Reclamation Service, and the infor-ation secured has been used to make a comprehensive scheme for the most efficient utilization of the power resources. This scheme provides for the development of the available power at nine sites, seven of which are on the main

Great Falls Development of the Manitoba Power Company, Winnipeg River, Manitoba.

river and two on the Pinawa channel, extending from the main river above Seven Sisters falls to Lac du Bonnet. Three sites are already developed, two on the main river and one on the Pinawa channel, as listed in the table of developed power.

The total fall of the river in Manitoba is 271 feet, and of this the amount developable is 250 feet. The two developments on the main river utilize, or have the right to utilize, 103 feet, and the remainder is available at five undeveloped sites. The undeveloped site on the Pinawa channel has a possible head of 18 feet.

At all of the sites on this river, conditions are ideal for construction. The bed and banks of the river are of rock, providing good foundations for the structures, and, in general, good pondage can be secured by the flooding of the lake-like expanses above. The sites are likewise easily accessible and at no great distance from existing railways. All these conditions make for the production of power at a cost comparing favourably with that of any produced elsewhere, and this is one of the important factors in the development of southern Manitoba.

Nelson River

The Nelson river drains lake Winnipeg, running northwesterly for a distance of about 430 miles to Hudson bay, and descending from an elevation of 710 feet to sea-level. The drainage area above its mouth is 450,000 square miles, and above its head in lake Winnipeg, 403,000 square miles. Remarkable natural regulation of the flow, combined with the large head available, makes this river one of the most important on the continent as a potential source of power. No development has as yet taken place but the future demands of the district can be supplied by the development of one or more sites as needed.

In its upper reaches, this river generally consists of lake-like expanses connected by short stretches containing falls or rapids, and in several places divided into two or more channels. The banks are close together and rocky, although of no great height, and good foundations are available. Proceeding down stream, the river gradually widens and attains an increasing current, and the falls and rapids are of less height. Of the total fall, it is estimated that 562.5 feet may be developed for power. The available power at each site is listed in the table.

As an illustration of the value of the water-powers of the Nelson river and their importance to the industrial growth and expansion of the province, attention is drawn to the Whitemud Falls site. An investigation of this site a few years ago by the department's engineers showed Whitemud falls to be the most outstanding power site in the province, capable of developing 180,000 continuous 24-hour horse-power which can be economically developed. The investigation also showed the feasibility of considerably increasing the power output of this site and all of the power sites on the Nelson river by utilizing the storage possibilities of Cross lake and lake Winnipeg. Situated almost in the centre of a district rich in forest and mineral resources, the Whitemud Falls site, with its abundance of cheap power, is the key to the utilization of these resources, and their development, which appears certain within the near future, is bound to create and open up new communities in the northern part of the province.

Saskatchewan River

The Saskatchewan river rises in many branches on the eastern slope of the Rocky mountains in Alberta, and these converge and unite to form the two main branches, the North and the South. These latter unite to form the main river about 28 miles east of the city of Prince Albert, and the river then flows eastward to its mouth in lake Winnipeg.

The basin of the Saskatchewan has an area of 171,000 square miles and has many topographic and meteorological variations. The principal run-off comes from the mountains, and as this is influenced largely by conditions of temperature

and precipitation in that area, the total flow of the river is subject to wide extremes. This is somewhat modified by the large lake areas along the lower reaches of the river, and at the power sites in Manitoba the range is not so great.

There are three power sites in Manitoba, all a comparatively short distance above the mouth of the river. All these sites have rock in evidence on the banks and in the bed, so that good foundation conditions are available. Access to the sites may most readily be obtained from lake Winnipeg, which provides a water route connection with the railways at its lower end.

DEVELOPED POWER

Table No. 1 shows the power already developed.

TABLE 1—HYDRAULIC INSTALLATIONS IN MANITOBA, 1926

Company or owner	River	Location of plant	Head in feet	Installed horse-power
Canada Gas & Electric Corporation	Minnedosa	Near Brandon	33	1,000
*Manitoba Power Commission	Minnedosa	Minnedosa	22	125
City of Winnipeg	Winnipeg	Point-du-Bois	46	102,900
Winnipeg Electric Co	Winnipeg	Pinawa channel	40	37,800
Manitoba Power Co	Winnipeg	Great Falls	56	84,000
Total				225,825

*Manitoba Power Commission purchases a block of power from the City of Winnipeg.

UNDEVELOPED POWER

Table No. 2 shows the head and power available at each of the undeveloped power sites, and the map attached shows the location of these sites.

TABLE 2—UNDEVELOPED POWER IN MANITOBA

River	Power site		Head in feet	H.P. at 80% Effic.	
	Index div.	Name		Ord.-min. power	6-month power
Berens	5RD$_{11}$	First Falls	25	1,540	2,155
	5RD$_{12}$	Tenth Falls	33	1,950	2,730
	5RD$_{13}$	Fourteenth Falls	25·5	1,475	2,060
	5RD$_{14}$	Below 23rd Falls	47	2,540	3,540
	5RD$_{15}$	Manitou Rapid	39	1,932	2,678
	5RD$_{16}$	Little Grand Rapids	24	3,130	4,775
				12,567	17,938
Big Black	5RF$_1$		13	151	235
	5RF$_2$		5	58	90
	5RF$_3$		6	70	109
	5RF$_4$		10	144	224
	5RF$_5$	Adjoining Rapid	20	287	447
	5RF$_6$		5	87	135
	5RF$_7$		5	87	135
	5RF$_8$		7	121	190
	5RF$_9$		5	87	135
	5RF$_{10}$	Skunkfeet Rapid	12	208	325
	5RF$_{11}$		9	156	244
	5RF$_{12}$		4	69	108
	5RF$_{13}$	Pelican Rapid	6	104	163
	5RF$_{14}$		8	157	245
	5RF$_{15}$	Long Rapid	57	1,120	1,745
	5RF$_{16}$		7	137	214
	5RF$_{17}$	Mink Rapid	5	98	153
	5RF$_{18}$	Island Rapid	15	312	485
	5RF$_{19}$	High Rapid	25	521	810
	5RF$_{20}$	Cathead Rapid	7	154	239
	5RF$_{21}$		13	286	444
				4,414	6,875

UNDEVELOPED POWER IN MANITOBA—*Continued*

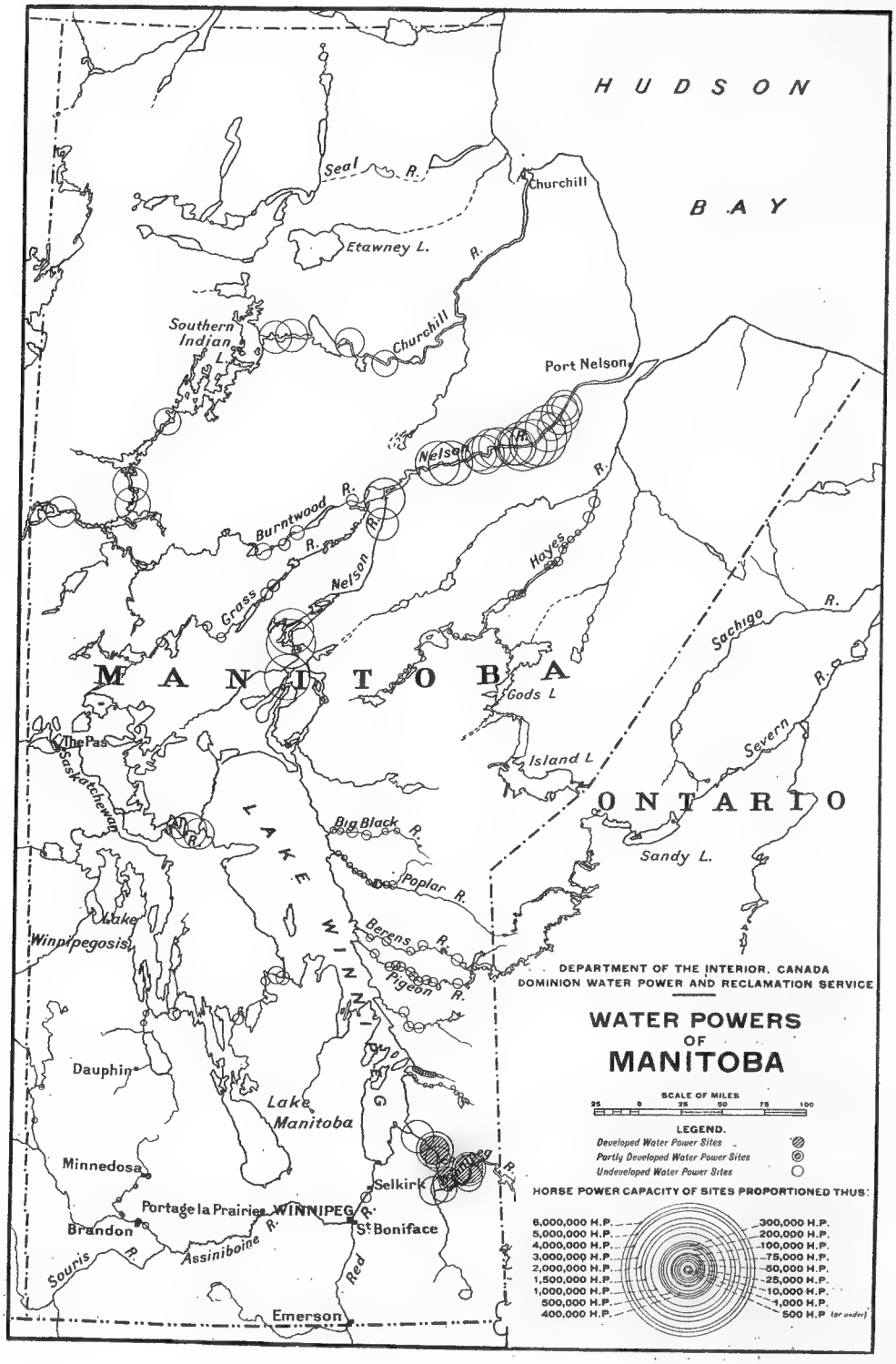
River	Power site		Head in feet	H.P. at 80% Effic.	
	Index div.	Name		Ord.-min. power	6-month power
Bloodvein	5RB1	Fourth Fall	30	1,335	2,180
	5RB2	Tenth Rapid	32	1,340	2,170
	5RB3	Tenth Fall	36	1,425	2,320
				4,100	6,670
Burntwood	5TF1	Taskinigup Fall	84	3,090	9,270
	5TF2	Jackpine Fall	34	1,390	4,175
	5TG1	Manaza Fall	42	1,870	5,610
	5TG2	First Rapid	49	2,450	7,350
				8,800	26,405
Churchill	6EA3	Bloodstone Fall	20	42,400	53,300
	6EA4		34	77,300	97,400
	6EA5	Granville Fall	30	68,200	85,900
	6EB1	Leaf Rapid	12	27,300	34,400
	6FA1	Missi Fall	20	49,800	62,500
	6FA2		18	44,800	56,300
	6FB1		15	37,400	46,900
	6FB2		10	24,900	31,300
				372,100	468,000
Dauphin	5LM1	Mile 12·4	6·5	1,410	1,902
	5LM2	Mile 28	29	6,300	8,490
	5LM3	Mile 31	16	3,480	4,680
				11,190	15,072
Fairford	5LK1		8	1,740	2,342
Grass	5TA1	Wekusko Rapid	55	550	1,640
	5TB1	Second Fall	42·8	818	2,450
	5TB2	First Fall	37	733	2,180
	5TC1	Lynx Fall	54	1,620	4,860
	5TC2	Sandy Fall	46	1,410	4,250
				5,131	15,380
Hayes	4AA1	Robinson Fall	56	250	743
	4AA2		5	30	89
	4AA3		7	45	135
	4AA4		6·5	62	186
	4AA5		8	128	384
	4AA6	Trout Fall	11	176	529
	4AA7	Upper Drum Rapid	12	283	850
	4AA8	Middle Drum Rapid	7	165	496
	4AA9	Lower Drum Rapid	10	235	708
	4AA10	Yellowmud Rapid	5	118	354
	4AB1		5	151	453
	4AB2		10	302	906
	4AB3	Muskeg Rapid	8	248	743
	4AB4		10	310	928
	4AB5		11	345	1,035
	4AB6		5	157	471
	4AB7	Whitemud Falls	5	162	491
	4AB8	The Rock Falls	5	166	497
	4AB9		35	1,178	3,500
	4AB10		35	1,206	3,630
				5,717	17,128
Manigotagan	5RA1	Wood Fall	29·5	195	525
	5RA2		16	106	285
	5RA3		30	190	505
	5RA4		12	75	200
	5RA5	Smooth Rock Portage	19	115	305
	5RA6	Charles Falls	29·5	170	450
	5RA7	Turtle Cascade	28	150	400
	5RA8		23	120	315
	5RA9	Caribou Falls	30	155	405
				1,276	3,390

UNDEVELOPED POWER IN MANITOBA—*Continued*

River	Power site		Head in feet	H.P. at 80% Effic.	
	Index div.	Name		Ord.-min. power	6-month power
Minnedosa	5MF1	Rapid City	20	9	58
	5MF2	Rivers	47	21	137
	5MF3	Pendennis	45	20	131
	5MF4		40	18	116
				68	442
Mossy	5LJ1	Wilson's Farm	13	89	228
	5LJ2	Winnipegosis	11·5	77	202
				166	430
Nelson	5UD1	Sea River Fall	35	159,090	257,090
	5UD2	Whitemud Falls	39·6	180,000	290,880
	5UD3	Chain of Rocks Rapid	35·4	161,000	260,030
	5UE1	Manitou Rapids	11	50.000	80,800
	5UE2	Chain of Islands Falls	24·6	111,820	180,700
	5UF1	Below Split Lake	30	136,360	220,360
	5UF2	Birthday Rapid	29·4	133,640	215,960
	5UF3	1st Gull Rapid	17	77.270	124,870
	5UF4	2nd Gull Rapid	21	95,500	154,250
	5UF5	3rd Gull Rapid	20	90,910	146,910
	5UF6	4th Gull Rapid	20	90,910	146,910
	5UF7	1st Kettle Rapid	17	77,270	124,870
	5UF8	2nd Kettle Rapid	21·5	97,730	157,930
	5UF9	3rd Kettle Rapid	40	181,820	293,820
	5UF10	Upper Long Spruce Rapid	40	181,820	293,820
	5UF11	Lower Long Spruce Rapid	52	236,360	381,960
	5UH1	1st Upper Limestone Rapid	35	159,090	257,090
	5UH2	2nd Upper Limestone Rapid	8	36,360	58,760
	5UH3	1st Lower Limestone Rapid	10	45,460	73,460
	5UH4	2nd Lower Limestone Rapid	10	45,460	73,460
	5UH5	3rd Lower Limestone Rapid	15	68,180	110,170
	5UH6	4th Lower Limestone Rapid	6	27,270	44,070
				2,443,320	3,948,170
Pigeon	5RD1	2nd Fall	23	3,160	4,160
	5RD2	5th Fall	23	3,065	4,035
	5RD3	7th Fall	13	1,725	2,275
	5RD4	5th Rapid	19	2,500	3,310
	5RD5	8th Rapid	16	2,100	2,760
	5RD6	10th Rapid	26	3,390	4,470
	5RD7	14th Rapid	23	2,980	3,925
	5RD8	15th Fall	25	3,230	4,250
	5RD9	18th Fall	28·5	3,660	4,810
	5RD10	Shining Fall	32	3,880	5,080
				29,690	39,075
Poplar	5RE1		20	590	917
	5RE2		16	471	733
	5RE3		9	313	446
	5RE4		4	153	242
	5RE5		9	344	544
	5RE6		4	153	242
	5RE7	Whitemud Rapid	9	377	586
	5RE8	Balsam Rapid	12	505	785
	5RE9	First Rapid	10	423	658
				3,329	5,153
Saskatchewan	5KL1	Upper Grand Rapids	57	31,100	103,600
	5KL2	Lower Grand Rapids	41	22,400	74,500
	5KL3	Flying Post and Demi Charge	10	5,500	18,200
				59,000	196,300
Shell	5MD1		10	21	65

UNDEVELOPED POWER IN MANITOBA—*Concluded*

River	Power site		Head in feet	H.P. at 80% Effic.	
	Index div.	Name		Ord.-min. power	6-month power
Wanipigow	5RA$_{10}$	20th Rapid	26	21	123
	5RA$_{11}$	19th Rapid	10	10	52
	5RA$_{12}$	17th Rapid	11	13	71
	5RA$_{13}$	15th Rapid	41	49	272
	5RA$_{14}$	14th Rapid	10	12	67
	5RA$_{15}$	12th Rapid	34	43	232
	5RA$_{16}$	10th Rapid	10	14	72
	5RA$_{17}$	7th Rapid	35	51	277
	5RA$_{18}$	Silver Fall	40	65	360
	5RA$_{19}$	5th Rapid	12	21	110
	5RA$_{20}$	4th Rapid	30	79	431
	5RA$_{21}$	1st Rapid	10	27	145
				405	2,212
Waterhen	5LH$_1$	Meadow Portage		3,770	5,030
Winnipeg	5PF$_1$	Pine Falls	37	51,900	85,400
	5PF$_2$	McArthur Falls	18	25,250	41,700
	5PF$_4$	Lower 7 Sisters Falls	37	25,000	58,800
	5PF$_5$	Upper 7 Sisters Falls	29	19,560	46,100
	5PF$_6$	Upper Pinawa	18	13,100	13,100
	5PF$_7$	Slave Falls	26	36,480	60,200
				171,290	305,300
Total for Province				3,138,094	5,081,377


HUDSON
BAY
Seal R.
Churchill
Etawney L.
R.
Southern Indian L.
Churchill R.
Port Nelson
Nelson R.
R.
Burntwood R.
R.
Nelson R.
Hayes R.
Grass R.
MANITOBA
Gods L
Sachigo R.
R.
Severn R.
The Pas
Saskatchewan R.
Island L
ONTARIO
Big Black R.
Sandy L.
LAKE WINNIPEG
Poplar R.
Berens R.
Pigeon R.
Lake Winnipegosis
Dauphin
Lake Manitoba
Minnedosa
Selkirk
Portage la Prairie
WINNIPEG
R.
Brandon
St. Boniface
Assiniboine R.
Souris R.
Red R.
Emerson
DEPARTMENT OF THE INTERIOR, CANADA
DOMINION WATER POWER AND RECLAMATION SERVICE
WATER POWERS
OF
MANITOBA
SCALE OF MILES
25 0 25 50 75 100
LEGEND.
Developed Water Power Sites
Partly Developed Water Power Sites
Undeveloped Water Power Sites
HORSE POWER CAPACITY OF SITES PROPORTIONED THUS:
6,000,000 H.P.
5,000,000 H.P.
4,000,000 H.P.
3,000,000 H.P.
2,000,000 H.P.
1,500,000 H.P.
1,000,000 H.P.
500,000 H.P.
400,000 H.P.
300,000 H.P.
200,000 H.P.
100,000 H.P.
75,000 H.P.
50,000 H.P.
25,000 H.P.
10,000 H.P.
1,000 H.P.
500 H.P (or under)

CLASSIFIED LIST OF PUBLICATIONS

WATER POWER

The Reports pertaining to Water Power, published by the Dominion Water Power and Reclamation Service, with the exception of the Annual Reports, have been called Water Resources Papers, and have been numbered 1, 2, etc.

Annual Reports previous to 1913 are included with the Annual Report of the Department of the Interior, and can be secured from the secretary of the department.

Annual Reports for the fiscal years ending March 31, from 1913 to 1925, are available for distribution. That for 1924 is the first report combining the activities of the Water Power and Reclamation divisions of the Service.

REPORTS OF SPECIAL OR GENERAL INTEREST

Water Resources Paper No. 2.—Report on Bow River Power and Storage Investigations, Bow River west of Calgary, by M. C. Hendry, chief engineer in charge of surveys. This is a complete study of the Bow river west of Calgary. It deals with meteorological conditions and their effect on run-off and ice formation. Existing and possible power and storage developments, together with maps and plans are appended complete. Published 1914.

Water Resources Paper No. 3.—Report on Power and Storage Investigations, Winnipeg River, by J. T. Johnston, chief hydraulic engineer, Dominion Water Power Branch. A complete study based on field surveys and office computations of the Winnipeg River basin; deals fully with history, international considerations, topography, climate, storage possibilities; describes existing and gives preliminary designs and estimates for possible power developments; discusses other sources of power and the power market. Maps, plans and all relevant data are appended. Published 1915.

Water Resources Paper No. 5.—Preliminary Report on the Pasquia Reclamation Project, by T. H. Dunn, chief engineer in charge of Reclamation Survey. This is a progress report of investigations carried out to determine the possibility of lowering the level of Cedar lake and its effect in a general scheme for reclaiming the low-lying lands contiguous to the Saskatchewan river in the Pasquia region. Published 1914. Out of print.

Water Resources Paper No. 6.—Report on cost of various sources of power for pumping in connection with the South Saskatchewan Water Supply Diversion Project, by H. E. M. Kensit. It deals with the problem of power for pumping water from the South Saskatchewan river for the supply of cities and towns in the central portion of South Saskatchewan. Published 1914. Out of print.

Water Resources Paper No. 7.—Report on the Manitoba Water Powers, by D. L. McLean, S. S. Scovil and J. T. Johnston, compiled for the Manitoba Public Utilities Commission. A general survey of the water-power situation in Manitoba, with all available general information and hydrometric data published to date in condensed form concerning the rivers in Manitoba. Published 1914.

Water Resources Paper No. 10.—General Guide for Compilation of Water Power Reports of the Dominion Water Power Branch, prepared for the guidance of field engineers of the Dominion Water Power Branch, by J. T. Johnston, chief hydraulic engineer. Published 1915. Limited edition.

Water Resources Paper No. 11.—Second Report on the Pasquia Reclamation Project by T. H. Dunn, chief engineer in charge of Reclamation Survey. This is a continuation Report based on further investigations as outlined under Water Resources Paper No. 5. Published 1915. Out of print.

Water Resources Paper No. 12.—Report on Small Water Powers in Western Canada, and discussion on sources of power for the Farm, by A. M. Beale. Part I is a brief description of certain small western water-power developments. Part II gives an analysis of requirements and cost data for the farm power supply. Published 1915. Out of print.

Water Resources Paper No. 13.—Report on the Coquitlam-Buntzen Hydro-Electric Development. A complete description of the project and of the details of construction, with plans, diagrams and illustrations, by G. R. G. Conway, chief engineer of the British Columbia Electric Railway Company, Limited. Published 1915.

Water Resources Paper No. 16.—Water Powers of Canada. A series of five pamphlets in one volume covering the water-power situation in Canada, prepared for distribution at the Panama Pacific Exposition, San Francisco, 1915, by G. R. G. Conway, consulting engineer, Toronto; Percival H. Mitchell, consulting engineer, Toronto; H. G. Acres, hydraulic engineer, Hydro-Electric Power Commission, Ontario; F. T. Kaelin, assistant chief engineer, Shawinigan Water and Power Co., Montreal; K. H. Smith, engineer, Nova Scotia Water Power Commission, Halifax, N.S. Published 1916. Out of print.

Water Resources Paper No. 17.—Canadian Hydraulic Power Development and Electric Power in Canadian Industry, by Charles H. Mitchell, consulting engineer to Dominion Water Power Branch. Part I deals with progress of utilization, features in design, construction and operation specially applicable to Canada. Description of certain typical Canadian water-power developments. Part II analyses the uses, growth and future of electrical power in Canadian industry. Published 1916. Out of print.

Water Resources Paper No. 20.—Report on the Interests Dependent on Winnipeg River Power, with Special Reference to the Capital Invested and the Labour Employed, by H. E. M. Kensit. A detailed study of the industrial growth and future power requirements of the district tributary to the Winnipeg River power sites. Published 1917. Out of print.

Water Resources Paper No. 27.—Directory of Central Electric Stations in Canada to January 1, 1919, compiled by J. T. Johnston, assistant director, Dominion Water Power Branch. Comprises an analysis of the central electric census statistics and a directory of the stations. Published 1919. Out of print.

Water Resources Paper No. 32.—Water Resources Index Inventory, by J. T. Johnston. Description of the Index Inventory System for recording and collating the water resources data of the Dominion. Published 1922. Out of print.

Water Resources Paper No. 33.—Directory of Central Electric Stations in Canada, to November 1, 1922. Comprises an analysis of the central electric station statistics and a directory of the stations. Published 1923. Price, 50 cents.

Water Resources Paper No. 55.—Directory of Central Electric Stations in Canada. In course of preparation.

SURFACE WATER SUPPLY REPORTS

ATLANTIC DRAINAGE SOUTH OF ST. LAWRENCE RIVER INCLUDING NOVA SCOTIA, NEW BRUNSWICK, PRINCE EDWARD ISLAND, AND SOUTHEASTERN QUEBEC

Water Resources Papers Nos. 29, 37, 45 and 52.—Surface water supply of Canada. Reports on hydrometric surveys covering the Atlantic drainage south of the St. Lawrence river, including Nova Scotia, New Brunswick, and Prince Edward Island and southeastern Quebec, for the climatic years ending September 30, 1919 to 1926, by K. H. Smith, district chief engineer. No. 52 is in course of preparation.

ST. LAWRENCE AND SOUTHERN HUDSON BAY DRAINAGE IN QUEBEC

Water Resources Papers Nos. 41 and 48.—Surface water supply of Canada. Reports on hydrometric surveys covering the St. Lawrence and Southern Hudson Bay drainage in Quebec for the climatic years ending September 30, 1923, 1924, 1925, by Leo G. Denis district chief engineer.

ST. LAWRENCE AND SOUTHERN HUDSON BAY DRAINAGE IN ONTARIO

Water Resources Papers Nos. 28, 34, 38 and 42.—Surface water supply of Canada. Reports on hydrometric surveys covering the St. Lawrence and southern Hudson Bay drainage in Ontario for the climatic years ending September 30, 1920 to 1925, by S. S. Scovil, district chief engineer.

ARCTIC AND WESTERN HUDSON BAY DRAINAGE (AND MISSISSIPPI DRAINAGE IN CANADA) IN ALBERTA, SASKATCHEWAN, MANITOBA, EXTREME WESTERN ONTARIO, AND NORTHWEST TERRITORIES

Water Resources Papers Nos. 4, 19, 22, 24 and 26.—Surface Water Supply of Canada. Reports on hydrometric surveys in Manitoba, from January 1, 1912, to September 30, 1919, by M. C. Hendry and C. H. Attwood, chief engineers. No. 4 contains a gazetteer of lakes and streams in Manitoba.

Water Supply Bulletins Nos. 1 to 11.—Surface water supply of Canada. Reports on hydrometric surveys in Alberta and Saskatchewan from 1908 to September 30, 1919, by P. M. Sauder and A. L. Ford, chief hydrometric engineers, Reclamation Service.

Water Resources Papers Nos. 31, 36, 40, 44, 46, 50 and 54.—Surface water supply of Canada. Reports on hydrometric surveys covering the Arctic and western Hudson Bay drainage (and Mississippi drainage in Canada) in Alberta, Saskatchewan, Manitoba, extreme western Ontario and the Northwest Territories, for the climatic years ending September 30, 1920 to 1926, by C. H. Attwood and A. L. Ford, district chief engineers. Nos. 50 and 54 are in course of preparation.

PACIFIC DRAINAGE IN BRITISH COLUMBIA AND THE YUKON TERRITORY

Water Resources Papers Nos. 1, 8, 14, 18, 21, 23, 25, 30, 35, 39, 43, 47, 51 and 53.—Surface water supply of Canada. Reports on hydrometric surveys covering the Pacific drainage in British Columbia and the Yukon Territory from May, 1911, to September 30, 1926. No. 1 is by P. A. Carson, chief engineer, the others by R. G. Swan and C. E. Webb, district chief engineers. No. 1 contains an outline of the history of the Railway Belt with special reference to its administrative, legal and physical problems in regard to water, and a gazetteer of the lakes and streams in British Columbia. No. 53 is in course of preparation.

MAP

Water Powers of the Dominion of Canada prepared in connection with the First World Power Conference, London, Eng., 1924.

RECLAMATION

Drainage Regulations.

Irrigation Regulations.

Annual Irrigation Reports—1894-1911. (Out of print.).

Annual Irrigation Reports—Calendar years 1912 to 1915.

Irrigation Surveys and Inspections Reports—Fiscal years 1915-16, 1916-17, 1917-18, 1918-19.

Annual Report of the Reclamation Service—1919-20, 1920-21, 1921-22, 1922-23.

Annual Report of the Water Power and Reclamation Service 1923-24, 1924-25, 1925-26.

Annual Stream Measurement Reports of Alberta and Saskatchewan—Water Supply Bulletins Nos. 1-11, 1909-1919. (Continued in Water Resources Papers Nos. 31, 36, 40, etc.).

Western Canada Irrigation Association Reports—(1st to 11th Convention, 1907-1917).

International Irrigation Congress Report (1914).

Bulletin No. 1—Irrigation in Alberta and Saskatchewan.
(Consisting of a Synopsis of the Irrigation Act and its Administration.)

Bulletin No. 2—Alfalfa Culture.

Bulletin No. 3—Climatic and Soil Conditions, C.P.R. Irrigation Block.

Bulletin No. 4—Duty of Water Experiments and Farm Demonstration Work.

Bulletin No. 5—Farm Water Supply.

Bulletin No. 6—Irrigation Practice and Water Requirements for Crops in Alberta.

Pamphlets:

Address by Mr. S. G. Porter—"Practical Operation of Irrigation Works."—Extract from W.C.I.A. Report, 1914.

Address by Dr. Rutherford—"Inter-dependence of Farm and City."—Extract from W.C.I.A. Report, 1914.

Address by Mr. Don. H. Bark—"The Actual Problem that Confronts the Irrigator."—Extract from W.C.I.A. Report, 1914.

Address by Mr. Don. H. Bark—"Practical Irrigation Hints for Alberta."—Extract from W.C.I.A. Report, 1915.

Address by Mr. Don. H. Bark—"Alfalfa Growing."—Extract from W.C.I.A. Report. 1915.

"Practical Information for Beginners in Irrigation" (by W. H. Snelson, A.M.E.I.C.).

Water Resources Papers, and Irrigation and Drainage Reports, as listed at the end of this report are issued gratis, with the exception of Water Resources Paper No. 33, for which a charge of 50 cents is made. These can be had on application to the Director of Dominion Water Power and Reclamation Service, Department of the Interior, Ottawa.